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THE CHINESE JUJUBE

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INTRODUCTION

The Chinese jujube (also known as Chinese date) is one of the five principal fruits in northern China, where it has been grown since ancient times. It belongs to the buckthorn family (Rhamnaceae) and to the genus *Zizyphus* Mill., of which there are about 50 species distributed throughout temperate and tropical regions. The genus derives its name from the word "Zizouf", the Arabic name of one of the species. Three or four species of *Zizyphus* are native to the Southwestern States and northern Mexico. All of these are thorny shrubs with small fruits that are little more than skin and seed. The Chinese jujube is a deciduous tree (fig. 1), rather small, and somewhat spiny, with firm, shining-green, oval or oblong leaves 1 to 3 inches long. The fruit is a drupe, elliptic or oblong, up to 2 inches long, with a thin dark-brown skin when ripe, and crisp, sweet, whitish flesh of applelike flavor, enclosing a hard two-celled pointed stone. As a rule the jujube is a heavy bearer, and the contrast of the smooth, dark-brown fruits with the glossy green foliage makes the tree decidedly ornamental.

The Chinese jujube was cultivated in northern China many centuries before the beginning of the Christian Era. A Chinese work, Pen Tsao Kang Mu, published 300 years ago by Li Shi Chen, listed 43 named varieties; hundreds are described in the more recent work. It is now widely distributed, extending from northern and central

China throughout northern India, Iran (Persia), Armenia, and Syria to the Mediterranean region, Spain, and France. Throughout most of this region, according to De Candolle, the jujube is found both

FIGURE 1.—A seedling jujube tree showing upright growth habit most common in cultivated varieties.

wild and cultivated. It was introduced into these countries several hundred years ago.

Although grown for hundreds of years in China, there are few references to the jujube in the early botanical or horticultural litera-

ture of western Europe. Since its introduction into the Mediterranean region, however, it has become better known, and all the more important dictionaries and works on gardening in Europe contain accounts of it.

The varieties known and sold in the markets of Europe are seedlings, the fruits of which are about the size of an olive and would probably never attract much attention in the American markets. European horticulturists appear never to have investigated the possibilities of the Chinese jujube.

A few seedling trees were grown in the United States as early as about 1837, but it was not until the late Frank N. Meyer, agricultural explorer, visited China in 1908 that scions of large-fruited varieties were introduced. Meyer's work resulted in the establishment in California and the Southwest of a number of the best and largest fruited forms of the jujube.

The fruiting of these varieties in this country, especially in Texas and California, stimulated interest among fruit growers and others, and there has been a gradual increase in the number of plantings made, resulting in a demand for information concerning propagation and utilization.

CULTURE

CLIMATE

The jujube grows vigorously in hot climates and reaches its best development where the weather is dry, the sunshine brilliant, the nights warm, and the summers long and hot. The southwestern section of the United States, with the exception of the elevated portions where the summer nights are too cool, and limited areas, such as coastal regions, where the humidity may retard fruit production, is well adapted to jujube culture. The drier sections of some of the Southern States have produced some excellent fruit. The jujube has withstood temperatures of −22° F. without injury, but growth in regions where the summers are cool is very slow, and the number of fruits produced is few or none, as compared with the rapid growth and abundant and regular fruiting secured where the temperature sometimes reaches 120° F. (fig. 2).

Because of its late flowering, the jujube is free from spring frost injury. In regions where the peach, almond, and apricot bloom in February the jujube does not begin to flower until about May 20, long after danger from frost is over. Those who have lost fruit crops from frost can appreciate the great advantage of a tree that produces a good crop year after year without being injured by late frosts.

SOIL

The jujube does well on a variety of soils. It has been observed in California making a vigorous growth and producing an abundance of fruit on heavy poorly drained soil where peaches and other fruits could not maintain themselves.

It has grown luxuriantly on slightly acid soils, but it does best on slightly alkaline soils. The jujube does better than most other fruits on poor soil, but its best development will be found in sandy loams which are neutral or slightly alkaline and well cultivated.

PLANTING

Throughout most of the region adapted to jujube culture the period extending from December to March is a good one for planting. The earlier they are planted the better, since this gives an opportunity for

FIGURE 2.—Fruiting branch of jujube showing typical crop.

the soil to become firmly packed about the roots before new growth starts.

The jujube is a small tree and can be planted 18 by 18 feet, but modern horticultural practice tends to give all orchard trees more space, and better results will be obtained by planting the jujube 20 by 20 feet. The general practice recommended for the planting of

trees and shrubs should be followed in planting the jujube. The hole should be slightly larger than is necessary, to allow the roots to retain their natural positions.

PRUNING

All of the short, recurved side branches should be removed from the young trees as they come from the nursery, and the main stem should be headed back to a height of 24 to 30 inches above the ground. As with other deciduous fruits, the second year 3 or 4 well-placed branches should be selected in such a way as to fill in and give the tree a good spread and keep it as symmetrical and well balanced as possible.

The jujube tree has a natural tendency to grow upright and somewhat narrower than most fruit trees. The main object in pruning should be to force the tree to spread and form a low flat head, in order to keep the fruit as near the ground as possible, for convenience in picking.

VARIETIES

There is a close resemblance in size, shape, and quality among many varieties that according to present information have no outstanding merit. The four varieties described in the following paragraphs were selected as being superior to any of the others.

MU SHING HONG

Mu Shing Hong (P. I. no. 22684)[1] is one of the best varieties. The fruit is large, 1⅛ to 1⅝ inches in length, 1 to 1½ inches in greatest diameter, ellipsoidal, and slightly flattened at the ends. The stone is of medium size, ¾ to 1¼ inches in length and three-eighths to one-half inch in greatest diameter. This variety sometimes bears fruits the bony portions of which do not harden, thus giving rise to what are termed seedless fruits. The stone has a strong acute tip at the distal end.

LANG

The Lang (P. I. no. 22686) is probably the best variety (fig. 3) for general purposes. Of the four varieties considered most promising for cultivation in the United States, it is the most easily propagated. The fruit is large, pear-shaped, 1½ to 2 inches in length, 1 to 1½ inches in greatest diameter. The stone is of medium size, seven-eighths to 1⅛ inches in length, one-fourth to three-fourths inch in greatest diameter, and tapers more abruptly toward the distal end, which terminates in a stout spine.

SUI MEN

The Sui Men variety (P. I. no. 38245) is of average size and is useful for many purposes. The fruit is of medium size, 1 to 1¾ inches in length, seven-eighths to 1½ inches in greatest diameter. In form it is ellipsoidal with some fruits unsymmetrical. The stone

[1] Serial number assigned by Division of Plant Exploration and Introduction.

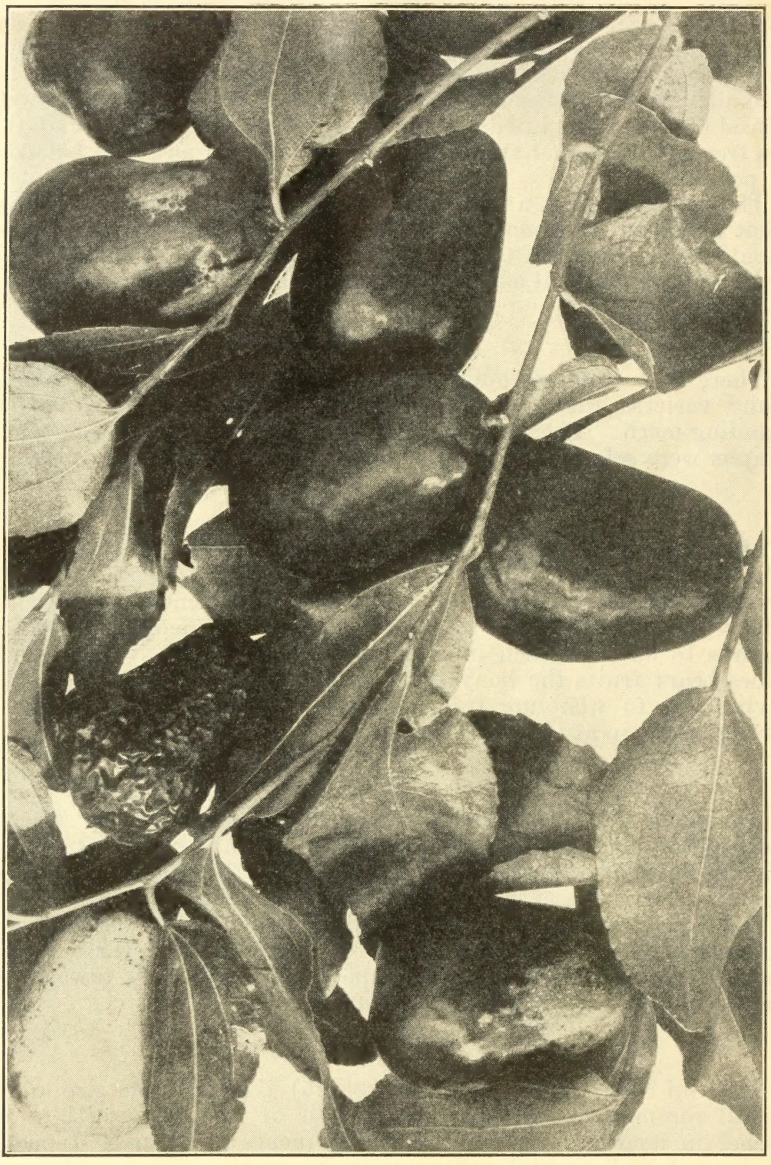

FIGURE 3.—The Lang jujube. The tree is a good bearer, and the large, pear-shaped fruits, which average 25 to 30 to the pound, are very satisfactory for processing. The various stages in ripening are shown above. (About natural size.)

is of medium size, three-fourths to 1⅛ inches in length, one-fourth to three-eighths inch in greatest diameter, and widest near the distal end, which is terminated by a long sharp spine.

LI

The Li variety (P. I. no. 38249), which is the largest-fruited introduction and was said by Meyer to be the largest known, is one of the best to eat as it comes from the tree, and it ripens the latest by 1 to 2 weeks. The fruit is 1⅛ to 2 inches in length, 1 to 2 inches in greatest diameter, and has a flesh which is crisp and processes well. The stone, while large, is smaller in proportion to the size of the fruit than those in the other three varieties. It is three-fourths to 1 inch in length, three-eighths to one-half inch in greatest diameter, and tapers abruptly toward the distal end, terminating in a short, thick spine.

The color of the fruit has not been discussed in these descriptions because it is not sufficiently distinct to be a varietal character. It varies with the different stages of maturity, appearing first on the green fruit as reddish-brown spots (fig. 3) that gradually increase in size until they finally merge. The color of the fruit is dark chestnut brown when these spots have all united. The fruit loses moisture and begins to wrinkle within a very few days after it has become fully colored.

The fleshy portion of the jujube fruit is drier than that of our common fruits. It does not vary sufficiently to become a varietal character. The flesh of the Li variety is more crisp than that of the other three varieties and is not quite so dry.

The date of ripening varies greatly. The fruit begins to ripen early in August in some portions of Texas and California, while in others it does not ripen until the first or middle of September. The ripening period in a given locality continues for 6 or 8 weeks, beginning with the fruit on the old wood and ending with that on the growth of the present year.

All varieties of jujubes come into bearing at an early age. Frequently the young plants in a nursery row bear fruit in less than 1 year, and under favorable conditions they may yield abundantly the second and third years after planting.

PROPAGATION

The jujube may be propagated by means of seeds, cuttings, buds, and grafts.

SEEDS

Seedling plants bear small fruits, most of which are little more than skin and seeds and are of value chiefly as stocks upon which to graft the large-fruited varieties. Seeds of the large-fruited varieties have a very low percentage of germination, whereas those of the small-fruited seedlings have a germination varying from 25 to 95 percent.

The fruit should be gathered as soon as it is ripe and covered with water or buried in wet soil. Under these conditions it will have fermented and decayed sufficiently in a week or 10 days to make it possible to remove the seeds without difficulty. After the pulp has

been removed, the surplus moisture should be drained from the seeds. They should then be stored and protected from heat and drying, or they may be stratified in sand and kept in a cool, moist place. Regardless of which method is used, the seeds should be stratified in moist sand in a warm place 3 or 4 weeks before they are to be put into the ground. Where greenhouse space is available, and the seeds are to be stratified in large quantities, a layer of sand about 2 inches deep may be spread on a bench having bottom heat. A piece of burlap should then be spread over the sand, and this, in turn, should be covered with a very thin layer of sand on which the seeds are spread in a thin layer and barely covered with sand. Over this another piece of burlap is spread and covered with about an inch of sand. The sand should be kept moist but not wet and at a temperature of about 70° F. Where this method is used, it is possible to stratify a large quantity of seeds and still be able to examine them from time to time by lifting one side of the upper piece of burlap.

If smaller quantities of seed are to be stratified, boxes of suitable size can be used and put in a warm place. After 2 or 3 weeks the seeds should be examined carefully every day or two, and as soon as they begin to crack open they should be placed in nursery rows. They should be sown in the row close enough together to form an almost continuous row of seed and covered with not more than 1½ inches of moist soil. Seeds that have been stratified in sand between strips of burlap can be screened from the sand, or the sand and seed can be drilled in the rows without screening.

The stratified seeds should not be submitted to heat too soon, or it may be necessary to plant them outside before the soil is thoroughly warmed. If cold weather follows after planting them outside, losses will occur because of the shock occasioned by taking the seeds from the warm sand bed and exposing them to cold. After planting, the soil should be kept pulverized above the seed to keep it from baking. When the young seedlings first appear, they are rather delicate and are often injured by having to push through a hard crust. The soil can be kept moist and open by covering the rows with a thin layer of straw, rice hulls, or some other mulch. The seeds should not have more than 1 to 1½ inches of soil over them, and care should be exercised not to use a mulch deep enough to keep the soil cool and thus retard germination.

The seed can be held over winter and planted without stratification when the soil has been thoroughly warmed in the spring, but when planted in this way the percentage of germination will not be so great as when stratification is employed and the seeds are handled as noted above. The jujube requires heat at all stages of its development.

If the quantity of seeds is not too great, they can be planted in beds instead of rows, thus insuring better care and a larger stand than under the row system. At the end of the first-season's growth the majority of the seedlings grown from seeds planted in nursery rows are large enough to graft, while only a small percentage of those grown in beds are of suitable size. The unsuitable plants from the beds should be grown 4 to 6 inches apart in rows during the second season.

CUTTINGS

Little or no success has resulted from repeated attempts to root any type of cutting taken from the portion of the plant above ground. When grafted plants are removed from the nursery a plant will occasionally be found in which the lower end of the scion has taken root.

Cuttings made by clipping the lower ends of the roots from the stock plants used for bench grafts have given a good percentage of plants of sufficient size to graft. Pieces of roots 4 to 6 inches in length and having a diameter of not less than three-sixteenths of an inch have produced good plants the first season, and these plants have good root systems. By the use of root cuttings the supply of stocks can be increased where seeds are not available. This method might also be employed to increase the supply of large-fruited varieties after they have once been rooted by layering or by the rooting of scions.

BUDDING

Propagating the jujube by budding has not as yet given very satisfactory results. The wood is very hard and the bark thin, making budding a difficult matter. The results of budding in August or September have been almost entirely negative. Spring budding has been more successful, but the percentage of trees secured by this method has been small.

GRAFTING

The most successful method of propagating the jujube has been by the ordinary whipgraft, although good results have been obtained both by bench and field grafting. While field grafting is somewhat slower than bench grafting, a better stand is obtained with less expense when one considers that digging and replanting are necessary in the latter case. When bench grafting is preferred, the plants can be dug in the fall and heeled in. Scion wood not smaller in diameter than that of a lead pencil (fig. 4, *a*) should be selected from the past season's growth at the time the grafting is done. The small side branches (fig. 4, *b*) which bear leafy deciduous branches are not suitable for scions. The grafting should be done 1 to 2 months before the plants are to be put in the nursery. After the graft has been made it should be carefully tied with raffia, waxed, and allowed to callus in damp shingle tow or moss at a temperature around 50° F. In about 3 to 8 weeks the callusing will have progressed sufficiently to allow the plants to be set out in the nursery. When the weather is suitable the plants should be lined out in nursery rows, and the soil should be heaped up so that the scion is covered 1 to 1½ inches. This will prevent the graft drying out, a precaution absolutely essential to success.

When the grafting is done in the field the scion wood can be cut at the same time, even though the trees are beginning to grow, for the bud that produces the new plant is a dormant one that does not start growth unless the short branch above it is cut off, as is the case in preparing the scion. As soon as the stock is full of sap and begins to push, the soil should be removed from around its base to allow sufficient room to whipgraft the scion on it at a point several inches

FIGURE 4.—Top of a jujube tree which has been cut back, showing new growth, small lateral branches, and spines: *a*, Wood suitable for propagation; *b*, twigs too small to be used in propagating; *c*, new branches resulting from cutting back the main branch.

below the surface of the soil. After tying the graft with raffia and waxing it, the soil should be replaced and heaped up sufficiently high to cover the scion to a depth of 1 to 1½ inches, as in the case of the bench grafts.

Where large seedling trees several years old are available or where stocks are too large to be successfully whipgrafted, the cleftgraft has been used. The operation is the same as for other fruits.

SUGGESTIONS FOR UTILIZING THE JUJUBE

Meyer found that the Chinese make use of the jujube in a number of ways. He says: "The fruits are eaten fresh, sun-dried, baked in bread, stewed with rice, millet, or meat. They are also prized for medicinal purposes, especially when several years old." As regards food value, the jujube stands high among fruits, as shown by analysis. It may be utilized as a fresh ripe fruit or in the dried condition. While not as desirable to eat out of hand as some other fruits, it is superior to most of them when put up as a confection. It has a distinct and pleasing flavor, making the fruit highly desirable. It can be used in many ways in the home. Directions for utilizing the fruit in various ways are given here, and these can be modified to meet the requirements of persons using them. They are offered chiefly as suggestions.

JUJUBE CONFECTION

The fruit of the jujube has been used more extensively in the United States as a confection than for any other purpose. It is also used in this way in China, where it is esteemed highly as a gift. To prepare the fruit as a confection it is necessary to cook it in sirup.

The thick skin of the fruit should be punctured or cut in some way before it is put into the sirup. The Chinese score or cut through it, using a bundle of small knives. The surface of the entire fruit is scored with this instrument. This permits the sirup to penetrate and gives a plump, attractive appearance to the finished product.

An instrument such as this will answer very well for this work, but if the quantity of fruit is too large to be handled in this way, or if one does not care to go to the trouble of making such an instrument, various other methods of puncturing the fruit may be used. When the number of fruits is small, a common table fork will suffice. The fruit is punctured three or four times with the fork as it is turned with the thumb and finger. This will allow the sirup to penetrate as the fruit is cooking. When a considerable quantity of fruit is to be processed, some kind of needle board should be made. This may be done by driving small brads through a piece of thin, even-grained box lumber, preferably from one-fourth to one-half inch in thickness.

The fruit should be punctured, placed in the sirup, and cooked from 20 to 35 minutes, the time depending on the size of the fruit. It is then allowed to cool in the sirup, after which it is again boiled for the same length of time. It is then taken out and placed on trays for drying, either in the sun or by artificial means. In the early fall 3 or 4 days in the sun will suffice to dry the fruit, but as the intensity of the heat decreases later in the season, more time will be required.

The fruit should be dried until it is firm, but not too hard. If insufficiently dried, when the fruit is placed in the mouth the soft flesh inside separates, leaving the skin. This difficulty will not arise if the fruit is properly dried.

The sirup is made by using 1 or 2 parts by volume of sugar to 1 of water, according to the taste of the individual. The use of the light sirup results in a product having more of the fruit flavor, but if a confection is desired a heavier sirup should be used. If the fruit is to be free from sugar on the outside, the boiling sirup should be made up to its original volume just before the fruit is taken out. The fruit should be well drained as it is removed. Where a sugar coating, as in glaceing, is desired, the original volume should not be renewed, but the fruit should be taken from the concentrated sirup and drained until the surplus sirup runs off. It should then be placed on a tray which has previously been covered with waxed paper. The addition of half a tablespoonful of salt to each quart of sirup is recommended when dried fruit is used. After the fruit has been removed the sirup should be made up to the original volume by adding water. About one-fourth pound of sugar should also be added for each pound of fruit used in the previous cooking. The sirup left after completing the processing is very tasty when used on hot cakes.

In sections where the summers are dry and there is little humidity in the atmosphere the fruit should be stored in containers having tight-fitting covers. Glass fruit jars or tin cans having tight-fitting spring covers can be employed if the fruit is to be held over or used during the summer season.

The fresh fruit as it comes from the tree can be punctured or scored, and after it is thoroughly dried it can be stored away in paper bags. It can then be processed at any subsequent time. It is easier to puncture or score the fruit when it is fresh and plump than after it is dry and wrinkled.

MISCELLANEOUS RECIPES

JUJUBE CAKE

1 cup white sugar
1 cup water
½ cup lard (not melted)
2 cups wheat flour
2 cups dried jujubes cut in small pieces
1 teaspoonful soda
½ teaspoonful salt

Mix together the sugar, water, lard, and fruit. Set over fire and let come to a good boil; then set aside to cool. Sift together twice the wheat flour, soda, and salt, and add to the other mixture when cool. Bake in moderate oven.

JUJUBE CAKE FILLING

2 cups jujubes
1 cup sugar
Juice and grated rind of one good lemon or orange
1 cup water
1 tablespoonful flour

Cook the jujubes 20 to 30 minutes; remove skin and seed by rubbing pulp through sieve or colander. Add sugar, juice, water, and flour and bring to a boil.

JUJUBE MOCK MINCEMEAT

1 pint green tomatoes and
1½ pints jujubes, ground fine in a food chopper
1½ cups sugar
1 cup raisins
½ cup vinegar
1 teaspoonful cinnamon
1 teaspoonful nutmeg
1 teaspoonful cloves
1 teaspoonful flour, in water

Mix the green tomatoes, jujubes, sugar, vinegar, and spices and cook for 30 minutes; then add flour (mixed with water), mix thoroughly, add raisins, and cook 15 minutes.

JUJUBE SWEET PICKLES

1 quart jujubes
3 cups sugar
1 cup vinegar
½ cup water
1 teaspoonful cinnamon
½ teaspoonful cloves
3 tablespoonfuls lye
½ teaspoonful alum

The fruit should be prepared by dipping in boiling lye water for about 3 minutes, or until the skin slips off readily. The lye water should be made in the proportions of 1½ ounces (3 tablespoonfuls) of lye to each quart of water. The fruit should be removed from the boiling lye and plunged into cold running water. It should be washed about 5 minutes and then boiled in alum water about 5 minutes. This should be made by using 1½ teaspoonfuls of alum to each 2 quarts of water. The fruit when removed from this should again be washed in running water 5 to 10 minutes, after which it should be removed and well drained. The fruit should then be placed in a sirup made by mixing the sugar, vinegar, water, cinnamon, and cloves and brought to a boil. Cook fruit until done, skim out, and put back when sirup is boiled down. The above is sufficient for 1 quart of pickles. The fruit should be placed in jars and sealed while hot.

JUJUBE BUTTER

6 pints jujube pulp
5 pints sugar
2 teaspoonfuls cinnamon
1 teaspoonful nutmeg
½ teaspoonful cloves
1 lemon
¼ pint vinegar

The fruit should be boiled until tender in sufficient water to cover it. It should then be rubbed through a sieve or colander to remove the skin and seeds.

Cook slowly until thick, put in jars, and seal while hot.

FUTURE OF THE CHINESE JUJUBE

The Chinese jujube will give to the drier sections of the South and Southwest a valuable and highly nutritious fruit of excellent flavor. To the American people this jujube, so long known in Asia, is at present little more than a name, but when it comes to be properly appreciated as a delicious fruit and a sure crop for sections where ordinarily little fruit is grown, it will become a valuable asset in these regions.

Until adequate machinery and methods for the commercial processing of this fruit are devised it will have a limited market, and it

would be inadvisable for any orchardist or farmer to invest large capital or to plant much of an acreage in jujubes.

The immediate future of the jujube is in its culture as a home fruit. As such it will appeal not only to the farmer but to the growers and residents generally in the drier States. Throughout this section a few jujube trees can well be planted in every home orchard, thus contributing to the variety of fruits by adding one that is highly nutritious, delicately flavored, and an abundant and sure producer.

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